

WINDBREAK/SHELTERBELT ESTABLISHMENT

(Feet)
Code 380

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

Linear plantings of single or multiple rows of trees or shrubs or sets of linear plantings.

II. Purposes

This practice may be applied as part of a conservation management system to support one or more of the following purposes:

- To reduce soil erosion from wind.
- To protect plants from wind-related damage.
- To alter the microenvironment for enhancing plant growth.
- To manage snow deposition.
- To provide shelter for structures, livestock, and recreational areas.
- To enhance wildlife habitat by providing travel corridors.
- To provide living noise screens.
- To provide living visual screens.
- To provide living barriers against airborne chemical drift.
- To delineate property and field boundaries.
- To improve irrigation efficiency.
- To enhance aesthetics.
- To increase carbon sequestration.

III. Conditions Where Practice Applies

This practice applies on any areas where linear plantings of woody plants are desired and suited.

IV. Federal, State, and Local Laws

Users of this standard shall comply with applicable federal, state and local laws, rules, regulations or permit requirements governing windbreak and shelterbelt establishment. This standard does not contain the text of federal, state, or local laws.

V. Criteria

A. General Criteria Applicable to All Purposes

Determine the location, layout, and density of the planting necessary to accomplish the purpose and function intended within a 20-year period.

Species must be adapted to the soils, climate, and site conditions.

Species shall be suited for the planned practice purpose(s).

Site preparation shall be sufficient for establishment and growth of selected species, shall not contribute to erosion, and shall be appropriate for the site. See NRCS Field Office Technical Guide (FOTG) Section IV Practice Standard 490, Forest Site Preparation.

Only viable, high quality and adapted planting stock or seed will be used. See NRCS Wisconsin Forestry Technical Note 4, Tree and Shrub Species for Windbreaks and Shelterbelts.

The planting will be done at a time and manner to insure survival and growth of selected species.

For optimal carbon sequestration, select plants that are adapted to the site to assure strong health and vigor, and plant the full stocking rate for the site.

Moisture conservation or supplemental watering shall be provided for plant establishment and growth where natural precipitation is too low for the selected species, or where soils are excessively well drained.

For the protection of the windbreak or shelterbelt, all livestock will be excluded from the area devoted to the practice, and the area will be protected from fire.

Windbreak and shelterbelt plantings will be continuous on one or more sides of the area to be protected that are exposed to the prevailing wind direction. Windbreaks will usually be located on the north or west sides of the protected area, or both.

The maximum design height (H) for a windbreak or shelterbelt shall be the expected height of the tallest row of trees or shrubs at age 20 years for the given site.

B. Criteria for Locations of Windbreaks and Shelterbelts

For prevention of soil erosion, the windbreak will be oriented as close to perpendicular as possible to the prevailing winds for the critical months of April and May.

For prevention of crop damage by wind-blown particles, orient the windbreak as close to perpendicular as possible to the prevailing winds for the critical month when crop damage is occurring.

Avoid planting trees or shrubs where they will interfere with structures and above or below ground utilities. Rows of trees or tall shrubs will be no less than 20 feet from utility lines and planted on the edge of the easement on transmission lines and pipelines to avoid maintenance problems. Very large species such as cottonwood and oak will be planted no less than 30 feet from utility lines. Maintain an 8-foot clear strip centered over underground electric distribution utility lines.

Precautions need to be taken so that tree roots do not interfere with any underground drain tile lines. Windbreaks and shelterbelts will conform to "Tree Roots," pages 5-6 through 5-7 of the NRCS Drainage Guide for Wisconsin.

To prevent ice hazards caused by shading on roads and driveways, no windbreak row will be less than 30 feet from the edge of the roadway. Windbreaks and shelterbelts south of roads will be placed a distance 2.8 times their mature height from the edge of the roadway.

Windbreaks will be located off road right-of-ways. Right-of-way distances on a given site can be obtained from the county highway department.

At road intersections or on curves, plantings will be positioned to avoid visibility hazards. Vision clearance requirements of streets and roads vary between townships, counties, and incorporated communities. Zoning ordinances shall be followed when siting windbreaks.

When windbreaks or shelterbelts are planted to the north or west of a road, the windward row will be no less than 120 feet from the edge of the roadway.

Windbreaks will be located a minimum of 20 feet from ditches and streams to minimize soil deposition into watercourses.

C. Criteria for Design of Windbreaks and Shelterbelts

The interval between windbreaks shall be determined using current, approved wind erosion technology. See USDA-NRCS, Wisconsin Field Office Technical Guide (FOTG), Section I, Part II, Estimating Soil Loss From Wind Erosion. Interval widths shall not exceed that permitted by the soil loss tolerance (T), or less than T, where plant protection is a concern. Calculations shall account for the effects of other practices in the conservation management system.

For wind erosion control, temporary measures will be installed to supplement the windbreak until it is fully functional.

Sites, fields, and plants are protected within an area 10 times the design height (H) on the leeward side and two times the design height (H) on the windward side of the windbreak. For design purposes, windbreak height will be based on the estimated height of the windbreak species at 20 years of age. (Refer to NRCS, Wisconsin FOTG, Section II, Windbreak Interpretations, and Wisconsin Forestry Technical Note 4).

A field windbreak should be designed to obtain a density at maturity equal to 50 to 60 percent of the density of a solid barrier. One to three rows of trees or shrubs at maturity typically provide the density desired.

Select tree and shrub species using the Windbreak Interpretations in Section II of the NRCS, Wisconsin FOTG and NRCS Wisconsin

Forestry Technical Note 4. Species selection should be made to fit the requirements of:

- soils
- climate
- height desired
- density
- width of crown
- tendency to retain branches
- rate of growth
- longevity
- disease and pest resistance
- aesthetic and wildlife value

Use a single species in a row where the soils permit. Avoid alternating species in the row because of growth variations.

Change species in the row when required by marked changes in the soil type.

In multiple row windbreaks use different species in each row to minimize total loss of the windbreak by disease, to increase windbreak longevity, for biological diversity, and for a better overall growth form of the windbreak.

Avoid the use of dense, slow growing species if other species are suited to the site.

Number of rows in a windbreak or shelterbelt:

1. A single row of trees or shrubs is adequate if a good stand and moderate density is maintained.
2. Two or more rows will be used where it is difficult to maintain a stand of trees or shrubs because of soil or other site factors.
3. Two or more rows may be used when the owner wishes to obtain a level of protection, wildlife benefit, or beautification not provided by minimum one-row designs.

Tree spacing within a windbreak or shelterbelt:

1. Within the row, minimum and maximum spacing will be:
 - a. Large broad-leaf trees:
 - (1) Single row: 10 to 15 feet
 - (2) Multiple rows: 10 to 20 feet

- b. Small and medium broad-leaf trees and conifers:

- (1) Single row: 6 to 12 feet
- (2) Multiple rows: 6 to 15 feet

- c. Shrubs, depending on species:

3 to 8 feet

2. The minimum spacing between rows will be 6 feet for a multiple row, high-density windbreak. Wider spacing will be used to accommodate cultivating and mowing equipment as appropriate.
3. Windbreaks for orchard protection should have a mature height of twice that of the orchard trees.

E. Criteria to Manage Snow Deposition

The living snow fence will be oriented as close to perpendicular to the snow-bearing wind as possible.

For snow distribution across a field, the density (during expected snow-producing months) shall not be less than 25 percent nor greater than 50 percent. The interval between barriers will not exceed 20H.

For snow accumulation, the minimum barrier density, during expected snow-producing months, will be 50 percent.

Living snow fences will be located so that snow deposition will not pose a health or safety hazard or obstruct human, livestock, or vehicular traffic. Normally, they should be located north of E-W roads and west of N-S roads. Where possible, extend at least 50 feet beyond the snow drift problem area.

Two and three-row living snow fences will be located so that the inside (leeward) row is no less than 65 feet from the primary area to be protected except for roads. Living snow fences of four or more rows will be located so that the outside (windward) row is not less than 100 feet from the primary area to be protected, except for roads.

The windward row will be a minimum of 150 feet or a maximum of 250 feet from the centerline of roads.

Water erosion and/or runoff from melting snow shall be controlled by supporting conservation practices where site conditions require protection.

F. Criteria to Provide Shelter for Structures, Livestock, and Recreational Areas

The planting will be oriented as close to perpendicular to the prevailing wind as possible. For wind protection, the minimum barrier density will be 65 percent during the months of most troublesome wind and the area to be protected will fall within a leeward distance of 10H.

Three or more rows of trees and shrubs will be used. A two-row design is permissible only when space does not permit a three-row design with minimum spacing between rows.

Spacing between individual plants shall be based on the needed growing space for plant type and species, the accommodation of maintenance equipment and the desired characteristics of the stems, branches and canopy as required for a specific purpose.

1. Minimum spacing between rows will be:
 - a. Between shrub rows: 10 feet.
 - b. Between rows of spruce, pine, cedar, or small broad-leaved trees such as willow: 12 feet.
 - c. Between rows of large broad-leaved trees such as hybrid poplar or oak: 14 feet.
 - d. Recommended minimum, mixed species: 14 feet.
2. Maximum spacing between rows will be 20 feet.
3. Minimum and maximum spacing within the row will be:
 - a. Large broad-leaved trees: 10 to 20 feet.
 - b. Conifers and small broad-leaved trees: 6 to 12 feet.
 - c. Shrubs, depending on species: 3 to 6 feet.

NOTE: The spacing within the row and between rows are approximate. It is difficult to plant trees at an exact spacing. This should be kept in mind when spot checking for compliance.

G. Criteria for Species Arrangement

Outside row windward side. Shade-tolerant conifers that will retain lower limbs in maturity may be used such as White or Norway Spruce, Eastern Red Cedar, or Northern White Cedar. A thick brushy shrub, such as dogwood, viburnum, or lilac is also suitable for this row.

Interior rows. Any tree species suited to the soil and climate may be used. Red Pine or White Pine are often used. The species should be at least as tall as the outside rows. A relatively fast grower is desirable to obtain heights as quickly as possible. Generally, conifers, except tamarack, are preferable to deciduous tree species.

Inside or leeward row, depending on the wishes of the landowner, may be:

- The same species as the interior row or rows, or
- A shrub attractive to wildlife such as American Cranberry, nannyberry, ninebark, or silky dogwood, or
- A flowering shrub such as lilac, or
- A dense, shade tolerant conifer such as spruce or cedar.

Fifty percent or more of the rows shall be of coniferous species unless soil limitations prevent their use.

In the event of marked changes in the soil within the row, the species will be changed to fit the soil.

For information on tree and shrub species suitable for windbreak planting, see Technical Note Woodland WI-17, dated July 1983. Also refer to the windbreak section on form NRCS-SOILS-5, Soil Interpretation Record, for the soils of the planting site.

Drainage of snowmelt from the windbreak shall not flow across the livestock area.

Barnyard runoff water will be diverted around trees and shrubs in the planting with a diversion

(NRCS FOTG Standard 362, Diversion), or through the planting in an underground outlet (NRCS FOTG Standard 620, Underground Outlet).

H. Criteria for Noise Screens

Noise screens shall be at least 65 percent dense during all times of the year, as tall as, and as close to the noise source as practicable.

The length of the noise screen shall be twice as long as the distance from the noise source to the receiver.

For high-speed traffic noise, the barrier width shall not be less than 65 feet wide. For moderate speed traffic noise, the barrier width shall not be less than 20 feet wide.

Species selected will be tolerant to noxious emissions, sand and gravel deposition, and salt spray from traffic areas.

I. Criteria for Visual Screens

Visual screens shall be located as close to the observer as possible with a density, height and width to sufficiently block the view.

J. Criteria For Providing or Enhancing Wildlife Habitat or Travel Corridors

Plant species selection shall benefit targeted wildlife species.

Design dimensions of the planting shall be adequate for targeted wildlife species.

K. Criteria for Improving Irrigation Efficiency

For sprinkler irrigation systems, the windbreak shall be nearly as tall as the sprinkler heads.

The barrier shall not interfere with the operation of the irrigation system.

VI. Considerations

To improve tree and shrub survival and growth, use of mulch, weed control mats, or weed control fabric should be considered. See NRCS FOTG Standard 484, Mulching, for more information.

To enhance aesthetics, use evergreen species or species with features such as showy flowers, brilliant fall foliage, or persistent colorful fruits.

Selection of plants for use in windbreaks should favor species or varieties tolerant to herbicides used in the area.

Plants that may be alternate hosts to undesirable pests should be avoided.

All plantings should complement natural features.

Tree or shrub rows should be oriented on or near the contour where water erosion is a concern. Where water erosion and/or runoff from melting snow is a hazard, it should be controlled by supporting conservation practices.

Wildlife should be considered when selecting tree or shrub species. Species diversity, including the use of native species, should be considered to avoid loss of function due to species-specific pests.

Consideration should be given to adverse offsite effects.

Plants established in windbreaks or shelterbelts should have root systems that do not affect crop growth and/or do not spread from root sprouts.

When planning windbreaks and shelterbelts, consider other NRCS FOTG Section IV standard practices as part of the wind erosion control system including 329A, Residue Management, No Till and Strip Till; 329B, Residue Management, Mulch Till; 344, Residue Management, Seasonal; 340, Cover Crop; 328, Conservation Crop Rotation; and 589B, Cross Wind Stripcropping.

VII. Plans and Specifications

Location on the conservation plan map and documented on the national windbreak Job Sheet, JS-125. Documentation will include number and location of rows, species in each row, spacing in rows and between rows and location in reference to area to be protected.

In lieu of a conservation plan, provide a location map and completed JS-125 in the case file.

Specifications for applying this practice shall be prepared for each site and documented in the conservation plan.

IX. Operation and Maintenance

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice and repair and upkeep of the practice.

To assure the survival of planted trees and shrubs, competing vegetation is to be controlled for a minimum of three years following windbreak planting.

Replacement of dead trees or shrubs will be continued until the barrier is functional.

Supplemental water will be provided as needed.

Thin or prune the barrier to maintain its function.

Inspect trees and shrubs at least annually and protect them from adverse impacts including insects, diseases, or competing vegetation. The trees or shrubs will also be protected from fire and damage from livestock and wildlife.

Periodic applications of nutrients may be needed to maintain plant vigor.

Plantings must be protected from farm and recreational vehicle traffic. Posting, flagging, and fencing can be used to exclude vehicles.

Commercially available tree shelters can be used to protect plantings from wildlife damage, protect from direct herbicide spray, and prevent damage by vehicles by making the trees more visible.

X. References

USDA, NRCS, Wisconsin Forestry Technical Note 4, Trees and Shrubs for Windbreaks and Shelterbelts.

USDA, NRCS, Wisconsin Field Office Technical Guide, Section II, Windbreak Interpretations.

USDA, NRCS, Wisconsin Field Office Technical Guide, Section I, Erosion Prediction-Part II, Estimating Soil Loss From Wind Erosion.

USDA, NRCS Wisconsin Field Office Technical Guide (FOTG), Section IV, Practice Standards and Specifications.